SEQUENCE LISTING

SEQ ID NO:1

Nucleotide sequence for HCMV Toledo US28 (same sequence as AU4.1)

ATGACACCGACGACGACGACCGCGGAACTCACGACGGAGTTTGACTACGATGAA
GCCGCGACTCCTTGTGTTTTCACCGACGTGCTTAATCAGTCAAAGCCGGTTACGT
TGTTTCTGTACGGCGTTGTCTTTCTGTTCGGTTCCATCGGCAACTTCTTGGTGATC
TTCACCATCACCTGGCGACGTCGGATTCAATGCTCCGGCGATGTTTACTTTATCA
ACCTCGCGGCCGCCGATTTGCTTTTCGTTTGTACACTACCTCTGTGGATGCAATAC
CTCCTAGATCACAACTCCCTAGCCAGCGTGCCGTGTACGTTACTCACTGCCTGTTT
CTACGTGGCTATGTTTGCCAGTTTGTGTTTTATCACGGAGATTGCACTCGATCGCT
ACTACGCTATTGTTTACATGAGATATCGGCCTGTAAAACAGGCCTGCCTTTTCAG
TATTTTTTGGTGGATCTTTGCCGTGATCATCGCCATTCCACATTTTATGGTGGTGA
CCAAAAAAAGACAATCAATGTATGACCGACTACGACTACTTAGAGGTCAGCTACC
CGATCATCCTCAACGTAGAACTCATGCTCGGTGCTTTCGTGATCCCGCTCAGTGT
CATCAGCTACTGCTACTACCGCATTTCCAGAATCGTTGCGGTGTCTCAGTCGCGC
CACAAAGGTCGCATTGTACGGGTACTTATAGCGGTCGTGCTTGTCTTTATCATCTT
TTGGCTGCCGTACCACCTAACGCTGTTTGTGGACACGTTAAAACTCCTCAAATGG
ATCTCCAGCAGCTGCGAGTTCGAAAGATCGCTCAAACGTGCGCTCATCTTGACCG
AGTCGCTCGCCTTTTGTCACTGTTGTCTCAATCCGCTGCTGTACGTCTTCGTGGGC
ACCAAGTTTCGGCAAGAACTGCACTGTCTGCTGGCCGAGTTTCGCCAGCGACTCT
TTTCCCGCGATGTATCCTGGTACCACAGCATGAGCTTTTCGCGTCGGAGCTCGCC
GAGCCGAAGAGAGACATCTTCCGACACGCTGTCCGACGAGGTGTGTCGCGTCTC
ACAAATTATACCGTAA

SEQ ID NO:2

Amino acid sequence for HCMV Toledo US28 (same sequence as AU4.1)

MTPTTTTAELTTEFDYDEAATPCVFTDVLNQSKPVTLFLYGVVFLFGSIGNFLVIFTIT
WRRRIQCSGDVYFINLAAADLLFVCTLPLWMQYLLDHNSLASVPCTLLTACFYVAM
FASLCFITEIALDRYYAIVYMRYRPVKQACLFSIFWWIFAVIIAIPHFMVVTKKDNQC
MTDYDYLEVSYPIILNVELMLGAFVIPLSVISYCYYRISRIVAVSQSRHKGRIVRVLIA
VVLVFIIFWLPYHLTLFVDTLKLLKWISSSCEFERSLKRALILTESLAFCHCCLNPLLY

VFVGTKFRQELHCLLAEFRQRLFSRDVSWYHSMSFSRRSSPSRRETSSDTLSDEVCRV
SQIIP*

SEQ ID NO:3

Nucleotide sequence for HCMV VHL/E US28

ATGACACCGACGACGACGACCGCGGAACTCACGACGGAGTTTGACTACGACGAT
GAAGCGACTCCCTGTGTCCTCACCGACGTGCTTAATCAGTCGAAGCCAGTCACGT
TGTTTCTGTACGGCGTTGTCTTTCTCTTCGGTTCCATCGGCAACTTCTTGGTGATCT
TCACCATCACCTGGCGACGTCGGATTCAATGTTCCGGCGATGTTTACTTTATCAA
CCTCGCGGCCGCCGATTTGCTTTTCGTTTGTACACTACCTCTGTGGATGCAATACC
TCCTAGATCACAACTCCCTAGCCAGCGTGCCGTGTACGTTACTCACTGCCTGTTTC
TACGTGGCTATGTTTGCCAGTTTGTGTTTTATCACGGAGATTGCACTCGATCGCTA
CTACGCTATTGTTTACATGAGATATCGGCCTGTAAAACAGGCCTGCCTTTTCAGT
ATTTTTTGGTGGATCTTTGCCGTGATCATCGCCATTCCACACTTTATGGTGGTGAC
CAAAAAAGACAATCAATGTATGACCGACTACGACTACTTAGAGGTCAGTTACCC
GATCATCCTCAACGTAGAACTCATGCTCGGTGCTTTCGTGATCCCGCTCAGTGTC
ATCAGCTACTGCTACTACCGCATTTCCAGAATCGTTGCGGTGTCTCAGTCGCGCC
ACAAAGGCCGCATTGTACGGGTACTTATAGCGGTCGTGCTTGTCTTTATCATCTTT
TGGCTGCCGTACCACCTGACGCTGTTTGTGGACACGTTGAAACTGCTCAAATGGA
TCTCCAGCAGCTGCGAGTTCGAAAAATCACTCAAGCGCGCGCTCATCTTGACCGA
GTCACTCGCCTTTTGTCACTGTTGTCTCAATCCGCTGCTGTACGTCTTCGTGGGCA
CCAAGTTTCGGCAAGAACTGCACTGTCTGCTGGCCGAGTTTCGCCAGCGACTGTT
TTCCCGCGATGTATCCTGGTACCACAGCATGAGCTTTTCGCGTCGGAGCTCGCCG
AGCCGAAGAGAGACGTCTTCCGACACGCTGTCCGACGAGGCGTGTCGCGTCTCA
CAAATTATACCGTAA

SEQ ID NO:4

Amino acid sequence for HCMV VHL/E US28

MTPTTTTAELTTEFDYDDEATPCVLTDVLNQSKPVTLFLYGVVFLFGSIGNFLVIFTIT
WRRRIQCSGDVYFINLAAADLLFVCTLPLWMQYLLDHNSLASVPCTLLTACFYVAM
FASLCFITEIALDRYYAIVYMRYRPVKQACLFSIFWWIFAVIIAIPHFMVVTKKDNQC
MTDYDYLEVSYFIILNVELMLGAFVIPLSVISYCYYRISRIVAVSQSRHKGRIVRVLIA
VVLVFIIFWLPYHLTLFVDTLKLLKWISSSCEFEKSLKRALILTESLAFCHCCLNPLLY

VFVGTKFRQELHCLLAEFRQRLFSRDVSWYHSMSFSRRSSPSRRETSSDTLSDEACRV
SQIIP*

SEQ ID NO:5

Nucleotide sequence for RhUS28.1

ATGAATAACACATCTTGCAACTTCAACGTCACTCTCAACGCATCGGCACCAAGCC
GATACATAGCTATTGCTATGTACAGCATTGTTATCTGTATCGGGTTGGTTGGAAA
CCTGCTGTTATGCATCGTGTTAGTCAAGAAACGCAAACTGCGATATTCCAGCGAT
GTTTATTTTTTCCACGCCTCTATGGCCGACCTCGTCAGCACTGTCATGCTACCGCT
CTGGCTACATTATGTCCTCAACTTTGCCCAACTCTCTCGAGGAGCCTGTATCAGCT
TTTCGGTGACTTTCTATGTTCCCCTTTTCGTTCAGGCCTGGTTACTCATTTCCATCG
CTATGGAGCGATATTCCAACTTAGTATGGATGGCACCCATTAGCGTTAAGACGGC
CTTTAAACACTGCATAGGAACCTGGATCGTATCTGCCTTCGTGGCATCACCCTAC
TACGCATACAGAAACTCACACGACGAACACGAATGCATTCTAGGAAACTACACT
TGGCACATTAACGAACCGCTACACACGTGTATGGATGTGGTGATCATAGTATGGA
CCTTTTTGGCCCCAGTACTGGTAACCATTATAGCAAGCGTCAAAATGAGACGAAC
GACCTGGGGCAATACTAGGTTAAACGAAAAGAACAGCGACATTCTTATAGTACT
AGTTGTCATGACAGTGTTCTTTTGGGGACCGTTTAATATCGTGTTGGTTATTGACA
ATATTTTACAGAGATACTATGATACCACGAATTGCGATGTAGAAAAGATTAAAC
ATATCATGGCTATGATCTCAGAAGCCATTGTTTATTTTCGCGGTATTACAGCACCT
ATTATTTATGTAGGGATTAGTGGCAGATTTCGCGAAGAGATTTACTCTCTGTTTA
GACGCCAGCCGTATAACGATTTGGACCCCGATGCCAATCAATTCATGATTGAACT
CACTAGCCAGGGAAGAAGTAGAAATAGAAATGCTAGACAATCGGAAAGCAATG
TACCGCAACCAGAAGAATGCTTCTGGTAA

SEQ ID NO:6

Amino acid sequence for RhUS28.1

MNNTSCNFNVTLNASAPSRYIAIAMYSIVICIGLVGNLLLCIVLVKKRKLRYSSDVYFF
HASMADLVSTVMLPLWLHYVLNFAQLSRGACISFSVTFYVPLFVQAWLLISIAMERY
SNLVWMAPISVKTAFKHCIGTWIVSAFVASPYYAYRNSHDEHECILGNYTWHINEPL
HTCMDVVIIVWTFLAPVLVTIIASVKMRRTTWGNTRLNEKNSDILIVLVVMTVFFWG
PFNIVLVIDNILQRYYDTTNCDVEKIKHIMAMISEAIVYFRGITAPIIYVGISGRFREEIY
SLFRRQPYNDLDPDANQFMIELTSQGRSRNRNARQSESNVPQPEECFW*

SEQ ID NO:7

Nucleotide sequence for RhUS28.2

ATGACCAACGCCGGACACTGTCACATAAACGAAAGTCTCGCGTCGTATGGAATC
GCTCCCGCAGCTACCATTACCTTATACAGCATTGCGGGAATCTGCGGTGTCACGG
GAAATCTGTTAATACTTTTGGTTTTGTTCACGAGACGCATACACTGGTTCGCAAA
TGACATCTACTATCTCAACATGATCTTTACAGACTTTCTTGTTTTCATTACATTAC
CCGCCTGGGTTTACTACCTGCTGAATTACACACAACTCTCACACTATGCCTGCATT
GCTCTATCATTTGTTTTTTACGTTTCCATTTTTATTCAAGCTGACTTTATGGTAGCA
GTGGCTATCGAGCGTTATCGAAGCCTAGTGAAAAACAAACCCCTTAGCGTAAAA
AAAGCCAGCGTCAGCTGCGCGTGCATCTGGATCATTGTTATTATAGTGTCTTCAC
CATACTACATGTTTAGATCGCAACACGAAACAAATTCTTGCATTCTAGGAAACTA
CACCTGGCATATGAACAGTCCTTTTCGCACCACAATGGACGCATCCATTAACATT
TGGTCTTTTGTCGTTCCGGCCGTGACGACCTTGTTAATAGCCAGACGAATTTATGT
ATGTACTTCAGGCAACAAAAAAATGAACGCCAGAGCCAGTGGTTTGTTAGAGGC
CATGGTGATTAGCATGTTATTCTTCGGAGGACTTTTCAACCTGAACATCTTTCGAG
ACATAGTTTCGGACACATCGGAAGACAATAAAGACTGCACATATCTTAAGCAGG
AACACTTTATTCGCATGGTCGGTGTGGCCCTCGTTTACGGGCGCGCTATATTCAA
CCCTTTTATGTATATGTGTGTGAGTACCAGATTGCGCCAAGAAATAAAATGTTTG
TTTATGCGAATACCTTATGAAACACTAGATGCAGAACACGCTAAACTCATGGTTA
ATTTAAAAAAACAGAAATGCTAATGTACCCGATCCTAAACCTCGTGAATATGAATC
TGTGTTATAG

SEQ ID NO:8

Amino acid sequence for RhUS28.2

MTNAGHCHINESLASYGIAPAATITLYSIAGICGVTGNLLILLVLFTRRIHWFANDIYY
LNMIFTDFLVFITLPAWVYYLLNYTQLSHYACIALSFVFYVSIFIQADFMVAVAIERYR
SLVKNKPLSVKKASVSCACIWIIVIIVSSPYYMFRSQHETNSCILGNYTWHMNSPFRTT
MDASINIWSFVVPAVTTLLIARRIYVCTSGNKKMNARASGLLEAMVISMLFFGGLFN
LNIFRDIVSDTSEDNKDCTYLKQEHFIRMVGVALVYGRAIFNPFMYMCVSTRLRQEIK
CLFMRIPYETLDAEHAKLMVNLKNRNANVPDPKPREYESVL*

SEQ ID NO:9

Nucletoide sequence for RhUS28.3

ATGACCAACACTAACAATACGACTTGTCATCTCAACGGAACTTTCGAAACTTTTA
AAATCACCCGTCCAGTAGCCATCAGCGCCTACACTGTACTCGTGGTTATCGGACT
TTTGGGAAACATTGTGCTGCTCAGCGTGCTCGTCGTGAAACGCAAGCTCAAGTTT
CCGAATGACATTTACTTTTTCAACGCGTCTTTGGCAGACGTTTTTGCCGTCTGCAT
GTTGCCCGCCTGGGTTAACTATGCACTGGACTCCACACAACTTAGCAAGTTCTCA
TGTATCACTTTTACGTTTGGTTTTTACGTCTCCCTGTTCATCCAGGCCTGGATGCT
CATTCTGGTCACCCTGGAGCGATACGGATCTCTAGTCTGGATCGCCCCGATCACC
AGAAACAAAGCCATAGCGAATTGTGTACTCTTTTGGCTTGTTTCCATCTTCTTGGC
CGCACCTTACTACTCTTTTAGAAACGAAAGCAACGAACACCAATGCATCATGAG
AAACTATACCTGGAGCGTTGGTGAAACATGGCACATAGCCCTGGATTTCTTAATT
ACGCTCATTACATTTATCATGCCAGTGACTATTGTGTTAGCTCTGAGTTTCAAAAT
GGCCAGATGGTCAACCTTTGGTTACAGAAACCTCACCAGCAGAACCAGTCTTATC
CTTATTTTGATACTGACAGTAGCAGCAGGGTTCTGGGGACCTTTTCACCTATTTAT
GTTTATAGAAAACGTGGCAGGGCAGATTTACCACATTCAAAAGGATTGCTGGTA
CTTACAGCTCAGACACTTGTGTAGCTTGATGACCGAAACCCTAGTGTTTCTACGT
TCAGTTTTTAACCCTTATATTTATATGATAATCAGTTACAAGTTTAGGCAGCAGGT
GCGCAGTCTACTCAAGCGTACTCAGTATGATGCTTTGGACACGACTCAGTTAGCA
GAAACTATGCAGCTGAAAGCGAAAGGTGTGCCGGTGTCCGACCCCGCGCCGCAT
GACTGCGAATGCTTTTTGTAA

SEQ ID NO:10

Amino acid sequence for RhUS28.3

MTNTNNTTCHLNGTFETFKITRPVAISAYTVLVVIGLLGNIVLLSVLVVKRKLKFPNDI
YFFNASLADVFAVCMLPAWVNYALDSTQLSKFSCITFTFGFYVSLFIQAWMLILVTLE
RYGSLVWIAPITRNKAIANCVLFWLVSIFLAAPYYSFRNESNEHQCIMRNYTWSVGE
TWHIALDFLITLITFIMPVTIVLALSFKMARWSTFGYRNLTSRTSLILILILTVAAGFWG
PFHLFMFIENVAGQIYHIQKDCWYLQLRHLCSLMTETLVFLRSVFNPYIYMIISYKFR
QQVRSLLKRTQYDALDTTQLAETMQLKAKGVPVSDPAPHDCECFL*

SEQ ID NO:11

Nucleotide sequence for RhU28.4

ATGAATTCGAGCCAGCACAACATAAGCGTGTTTCTCTCCATTGGAGCAGGGCCCG
TCATTACCGGATACACGTGCGTTTTTCTGTTCGGGATTCTGGGACACTTTTACTTG

TATTGGAAAAACCATCAGAGACGACACCGGACAAACAGTTTCAGTGATGTTTTAT
TTCGACATCTCATGATCACCGAAGAGGTCTTTACCCTCACCATTCCCGTCTGGGC
GTATCACTTAACTACTCACGGCAACTTACCGGGCTCGTGGTGCCGAAGTCTCACC
TTCGTTTTTTATCTAACGGTATTCGCTCGTGCCTTCTTTTACCTGCTCCTCATCTGG
GACCGATACAGCGTAATCATCTGCAGACACCCTCTCCCCGTTAATCTGAACTACA
GTCAGGTCATAGGCCTGTCTGTCTGGCTGGTTGCCGTACTGTCAGCATCACCGTT
CTCCATTTTTAACGGAAGTGTGAAACAATGCCTGGGCAACATGGGCAGCATACCC
AGCGAATCGTCTGCCGTTCTTAACCTGGAAGTGCACCTGTGCTCCTTCTGGTTACC
GCTCATCATGTCGGCTAACTGTTACTACCAAGCAAAACGCCGAGCATCGCCTGAC
CAACTCCACGAACTTTACCGATGCAGTTTGCTAATTACCATTATCACAACTTACG
CTATCGTATGGTTTCCTTTCCATCTCGCTTTACTCATAGACGCCCTGATTAGCATA
AGCCATGTAGAACCCTCTAGCGCTCTCCACTGGGCATCCATTGTCGTTACCTGTA
AATCATTTACATTTGTATATGCGGGCATAAGCCCACTAGTGTATTTCACATGCTG
CCCCACCGTACGTCGCGAACTGCTGATGTCTCTACGTCCATTCTTCACCTGGATTT
CCAGCAAAACGCGGCGAGGCTACGCTCCGATTAAAACACAACCTTTAAACATCC
CCGACGAGCCGATAGATAACAAGTCACCGCACCTGTTAAACGAATAA

SEQ ID NO:12

Amino acid sequence for RhU28.4

MNSSQHNISVFLSIGAGPVITGYTCVFLFGILGHFYLYWKNHQRRHRTNSFSDVLFRH
LMITEEVFTLTIPVWAYHLTTHGNLPGSWCRSLTFVFYLTVFARAFFYLLLIWDRYSV
IICRHPLPVNLNYSQVIGLSVWLVAVLSASPFSIFNGSVKQCLGNMGSIPSESSAVLNL
EVHLCSFWLPLIMSANCYYQAKRRASPDQLHELYRCSLLITIITTYAIVWFPFHLALLI
DALISISHVEPSSALHWASIVVTCKSFTFVYAGISPLVYFTCCPTVRRELLMSLRPFFT
WISSKTRRGYAPIKTQPLNIPDEPIDNKSPHLLNE*

SEQ ID NO:13

Nucleotide sequence for RhUS28.5

ATGACTACCACCACAATGAGTGCTACCACGAATTCCAGTACCACGCCTCAAGCA
AGCAGCACCACGATGACAACGAAGACAAGCACTCCTGGCAATACAACTACTGGC
ACTACGTCCACCCTGACAACGATATCAACAACTTCTAATGCTACCAGCATAACGT
CTAATTTAAGCACTACCGGAAACCAAACTGCAACTACCAATGCTACTACCTTCAG
TTCCACATTAACAACATCTACAAATATAAGCAGTACATTTTCGACAGTTTCTACC

GTCGCATCCAATGCAACATGTAATTCTACAATCACAACGAATATTACAACTGCTT
TTACTACAGCAGCAAACACTACCGCAAGCAGCCTCACCAGCATCGTAACTTCACT
TGCCACTACCATTGAAACCACATCATTTGATTATGATGAGTCAGCAGAAGCTTGC
AACTTAACAGACATCGTTCATACTACTAGATCAGTGACAGTTACTTTCTATACTA
TCATATTCATACTCGGCCTTTTGGGAAACTTTCTGGTTCTTATGACCATCATTTGG
AACCGTCGCATTTCCTTTATGGTTGAAATATATTTCGTTAATCTAGCAATCTCCGA
TCTTATGTTTGTATGTACTTTACCATTTTGGATAATGTATCTTCTTGAGCACGACG
TCATGTCACATGCATCCTGTGTAGCAATGACAGCCATTTTTTATTGCGCGCTGTTT
GCCAGCACTGTTTTCCTCTTGCTAATTGTTTTAGACAGATGTTACGCTATTCTATT
AGGTACAGAAAAAGCAAATAGACGTTTATTGCGCAATGCTGTTTCTGGATGCATG
CTCATGTGGGGATTGTGTTTCATTTTAGCATTACCTCATTTTATCTTTATGAAGAA
AGGAACCAACGTATGTGTAGCAGAGTATGAACCAGGACTTAACAATTTCTATGTT
ATTTTTATCAATACTGAGGTGAACCTATGCACCCTAGTTTTGCCAGCCGCAGCCA
TTATCTACTGGTATCTTAAACTAACCAAAGCACTCAAAACCCATGAACGACTGCG
TCATAGGCTAACGTCTCTAAACATAGTGTTAGCTGTTGTCATTGTATTTGCTTTGT
TTTGGCTGCCGTATAATCTCATGCTTATGATGTATAGCTTAGTTCACATGCAGATA
CCTTGGGAATGCAGCTCTGAAAAAATACTGAGACGAAGTTTAATTATTACAGAAT
CCATCGCCCTCAGTCACTGTTGCATCAACCCCATTATCTACTTGCTCTTCGGACCT
CGCTGTCGAAGCGAGTTCTGTCACCTGTTGCGATGTTGCTTTACGCGCTTATGTCC
ACACAGATCCTGGAGTTCCATACGTGCAGAGACGGTGTCCATCAGTCTCAGTCAC
TCACAGGTATCTGCATCATCTGAGGATGATGACAACGATGTGCATGATGAATTGC
AATTTTTAATTTGA

SEQ ID NO:14

Amino acid sequence for RhUS28.5

MTTTTMSATTNSSTTPQASSTTMTTKTSTPGNTTTGTTSTLTTISTTSNATSITSNLSTT
GNQTATTNATTFSSTLTTSTNISSTFSTVSTVASNATCNSTITTNITTAFTTAANTTASS
LTSIVTSLATTIETTSFDYDESAEACNLTDIVHTTRSVTVTFYTIIFILGLLGNFLVLMTII
WNRRISFMVEIYFVNLAISDLMFVCTLPFWIMYLLEHDVMSHASCVAMTAIFYCALF
ASTVFLLLIVLDRCYAILLGTEKANRRLLRNAVSGCMLMWGLCFILALPHFIFMKKG
TNVCVAEYEPGLNNFYVIFINTEVNLCTLVLPAAAIIYWYLKLTKALKTHERLRHRLT
SLNIVLAVVIVFALFWLPYNLMLMMYSLVHMQIPWECSSEKILRRSLIITESIALSHCC
INPIIYLLFGPRCRSEFCHLLRCCFTRLCPHRSWSSIRAETVSISLSHSQVSASSEDDDN
DVHDELQFLI*

SEQ ID NO:15

Nucleotide sequence for HCMV AD169 UL78

ATGTCCCCTTCTCTGTGGAGGAGACTACCTCAGTCACCGAGTCCATCATGTTCGCTA
TTGTGAGTTTCAAACACATGGGCCCGTTCGAAGGCTACTCTATGTCGGCCGATCG
CGCCGCCTCGGATCTACTCATCGGCATGTTCGGCTCCGTTAGCCTGGTCAACCTG
CTGACTATCATCGGTTGCCTCTGGGTGTTGCGTGTTACGCGGCCGCCCGTGTCCGT
GATGATTTTTACTTGGAATCTGGTACTTAGTCAGTTTTTTTCCATCCTGGCCACCA
TGTTGTCCAAGGGTATCATGCTGCGTGGCGCTCTAAATCTCAGCCTCTGTCGCTTA
GTGCTCTTTGTCGACGACGTGGGCCTATATTCGACGGCGTTGTTTTTCCTCTTTCT
GATACTGGATCGTCTGTCGGCCATATCTTACGGCCGTGATCTCTGGCATCATGAG
ACGCGCGAAAACGCCGGCGTGGCGCTCTACGCGGTCGCCTTTGCCTGGGTTCTTT
CCATCGTAGCCGCTGTGCCCACCGCCGCTACGGGTTCACTGGACTACCGTTGGCT
AGGCTGTCAGATCCCTATACAGTATGCCGCGGTGGACCTCACCATCAAGATGTGG
TTTTTGCTGGGGGCGCCCATGATCGCCGTACTGGCTAACGTGGTAGAGTTGGCCT
ACAGCGATCGGCGCGACCACGTCTGGTCCTACGTGGGTCGTGTCTGCACCTTCTA
CGTGACGTGTCTCATGCTGTTTGTGCCCTACTACTGCTTCAGAGTCCTACGCGGTG
TACTGCAGCCCGCTAGCGCGGCCGGCACCGGTTTCGGCATTATGGATTACGTGGA
ATTGGCTACGCGTACCCTTCTCACCATGCGTCTTGGCATTCTGCCGCTCTTTATCA
TTGCGTTCTTCTCCCGCGAGCCCACCAAGGATCTGGATGACTCCTTTGATTATCTG
GTCGAGAGATGTCAGCAAAGCTGCCACGGTCATTTCGTACGTCGGTTGGTGCAGG
CGTTGAAGCGGGCTATGTATAGCGTGGAGCTGGCCGTGTGTTACTTTTCTACGTC
CGTCCGAGACGTCGCCGAGGCGGTGAAAAAGTCCTCCAGCCGTTGTTACGCCGA
CGCGACGTCGGCGGCCGTTGTGGTAACGACAACCACGTCGGAGAAAGCCACGTT
GGTGGAGCACGCGGAAGGCATGGCTTCCGAAATGTGTCCTGGGACTACGATCGA
TGTTTCGGCCGAAAGTTCCTCCGTCCTCTGCACCGACGGCGAAAACACCGTCGCG
TCGGACGCGACGGTGACGGCATTATGA

SEQ ID NO:16

Amino acid sequence for HCMV AD169 UL78

MSPSVEETTSVTESIMFAIVSFKHMGPFEGYSMSADRAASDLLIGMFGSVSLVNLLTII
GCLWVLRVTRPPVSVMIFTWNLVLSQFFSILATMLSKGIMLRGALNLSLCRLVLFVD
DVGLYSTALFFLFLILDRLSAISYGRDLWHHETRENAGVALYAVAFAWVLSIVAAVP

TAATGSLDYRWLGCQIPIQYAAVDLTIKMWFLLGAPMIAVLANVVELAYSDRRDHV
WSYVGRVCTFYVTCLMLFVPYYCFRVLRGVLQPASAAGTGFGIMDYVELATRTLLT
MRLGILPLFIIAFFSREPTKDLDDSFDYLVERCQQSCHGHFVRRLVQALKRAMYSVEL
AVCYFSTSVRDVAEAVKKSSSRCYADATSAAVVVTTTTSEKATLVEHAEGMASEMC
PGTTIDVSAESSSVLCTDGENTVASDATVTAL*

SEQ ID NO:17

Nucleotide sequence for RhUL78

ATGATTACGGAGCGCGTCCTCGCAGGCATCCTCGCGGGCATGACGGCCGCGGGG
AGTTTGGTCATTCTCCTCGCGGTTGTTATGTGGTTGAACATGTTAGATCGCGCTGG
CATGCCAATGGCCGTTGGGCATTACACAGGGAACCTGGTGTTGACTCAGGTCATC
TGTATCTTCTCCATGCTGGCGTCTAAAATTGTTGGCATGACGAGTGCGGCCAACA
TGGGCTTCTGCGGCATCGTGGTTTTTCTGGAAGACACTGGCCTCTATGTCACCTCG
CTGCTCTTCATGTTTATGATCCTGGATCGCATGGCGGCTTTTCTTAACGGGCGTCT
TTTCTGGAGGCAGCAGACGACGAAGCAGAATCTGAGTACAAGCGTGTACATTAT
TCTGTTTTGCTGGGTGTTGGGAATGGCCGCGGCTGTTCCCAGCGCGGCTGTGGCT
GCACCCAATTCCAGGTGGGAACGCTGCGAAATTCCAGTGTCATATGCCGCAATCG
ACATGATTGTGAAGCTCTGGTTTGTGCTGTTGGCACCCGTCGTGCTGATTATGGCT
GTGATCATTCAATCTTCCTATCATCGTGATCGGGAGAGGATCTGGTACTATGCCA
GACGTGTGTTCATGTTCTACACGGCCTGCTTTGTCATGATGGTGCCTTATTACTTC
GTCAGAGTCATGCTGAGCGACTTTGCTTTGGTTGATATAAAAACAAAAACGGCG
AACAGCGACGGTTGTGATTCGACATTTCTTGATTATCTGAACATGTTCACTCACG
TGATTTACAGTTTTAAGTTGGTGGTGTTTGCTTTGTTCATTGTCCTGTTTTGCTCCA
TAAACCCGATGGAAACGCTGGAAGAATGCTTGGAGAGGGCCGATGCTGAGAGGC
AAAGTCGGTCAGAAGCATCCCAGGGTGAAAGGAGGCTGCCAATCAACACATGCT
GTATAAAGTTGATTGAATTGATAAAGCAGTATGTAAGCACTCTCTCTAAAGCCAC
GAGGGACAATTCTGGCGAAAGGGCCAATTTGCCAGAGAATGCTGAAGATATTGG
AACAACTGGCAGTGATCAGCTACCGACTGAGGTCACCGTGACCCCAAATTCATC
GGCTGTGTTTAGCACTGGAGGAACGGTGTCTCCAGTCTAA

SEQ ID NO:18

Amino acid sequence for RhUL78

MITERVLAGILAGMTAAGSLVILLAVVMWLNMLDRAGMPMAVGHYTGNLVLTQVI
CIFSMLASKIVGMTSAANMGFCGIVVFLEDTGLYVTSLLFMFMILDRMAAFLNGRLF
WRQQTTKQNLSTSVYIILFCWVLGMAAAVPSAAVAAPNSRWERCEIPVSYAAIDMIV
KLWFVLLAPVVLIMAVIIQSSYHRDRERIWYYARRVFMFYTACFVMMVPYYFVRVM
LSDFALVDIKTKTANSDGCDSTFLDYLNMFTHVIYSFKLVVFALFIVLFCSINPMETLE
ECLERADAERQSRSEASQGERRLPINTCCIKLIELIKQYVSTLSKATRDNSGERANLPE
NAEDIGTTGSDQLPTEVTVTPNSSAVFSTGGTVSPV*

SEQ ID NO:19

Nucleotide sequence for HCMV AD169 UL33

ATGACAGGGCCGCTATTCGCCATTCGAACCACCGAAGCCGTACTCAACACATTCA
TCATCTTCGTGGGCGGTCCACTTAACGCCATAGTGTTGATCACGCAGCTGCTCAC
GAATCGCGTGCTTGGCTATTCGACGCCCACCATTTACATGACCAACCTCTACTCT
ACTAATTTTCTCACGCTTACTGTGCTACCCTTTATCGTACTCAGCAACCAGTGGCT
GTTGCCGGCCGGCGTGGCCTCGTGTAAATTTCTATCGGTGATCTACTACTCAAGC
TGCACAGTGGGCTTTGCCACCGTAGCTCTGATCGCCGCCGATCGTTATCGCGTCC
TTCATAAACGAACATACGCACGCCAATCATACCGTTCAACCTATATGATTTTGCT
ATTGACATGGCTCGCTGGACTAATTTTTTCCGTGCCCGCAGCTGTTTACACCACG
GTGGTGATGCATCACGATGCCAACGATACCAATAATACTAATGGGCACGCCACC
TGTGTACTGTACTTCGTAGCTGAAGAAGTGCACACAGTGCTGCTTTCGTGGAAAG
TGCTGCTGACGATGGTATGGGGTGCCGCACCCGTGATAATGATGACGTGGTTCTA
CGCATTCTTCTACTCAACCGTACAGCGCACGTCACAGAAACAAAGGAGTCGTACC
TTAACCTTTGTTAGCGTGCTACTCATCTCCTTCGTGGCGCTACAAACTCCCTACGT
CTCTCTCATGATCTTCAACAGTTATGCCACAACCGCCTGGCCCATGCAGTGTGAA
CACCTCACACTGCGACGCACCATTGGCACGCTGGCGCGTGTGGTGCCCCACCTAC
ACTGCCTCATTAATCCCATCCTGTACGCGCTGCTGGGTCATGATTTTCTGCAACGC
ATGCGGCAGTGTTTCCGCGGTCAGTTGCTGGACCGCCGCGCTTTCCTGAGATCGC
AGCAGAATCAGCGAGCTACAGCGGAGACAAATCTAGCGGCTGGCAACAATTCAC
AATCAGTGGCTACGTCATTAGACACCAATAGCAAAAACTACAATCAGCACGCCA
AACGCAGCGTGTCTTTCAATTTTCCCAGCGGTACGTGGAAAGGCGGCCAGAAAA
CCGCGTCCAACGACACATCCACAAAAATCCCCCATCGACTCTCACAATCGCATCA
TAACCTCAGCGGGGTATGA

SEQ ID NO:20

Amino acid sequence for HCMV AD169 UL33

MTGPLFAIRTTEAVLNTFIIFVGGPLNAIVLITQLLTNRVLGYSTPTIYMTNLYSTNFLT
LTVLPFIVLSNQWLLPAGVASCKFLSVIYYSSCTVGFATVALIAADRYRVLHKRTYAR
QSYRSTYMILLLTWLAGLIFSVPAAVYTTVVMHHDANDTNNTNGHATCVLYFVAEE
VHTVLLSWKVLLTMVWGAAPVIMMTWFYAFFYSTVQRTSQKQRSRTLTFVSVLLIS
FVALQTPYVSLMIFNSYATTAWPMQCEHLTLRRTIGTLARVVPHLHCLINPILYALLG
HDFLQRMRQCFRGQLLDRRAFLRSQQNQRATAETNLAAGNNSQSVATSLDTNSKNY
NQHAKRSVSFNFPSGTWKGGQKTASNDTSTKIPHRLSQSHHNLSGV*

SEQ ID NO:21

Nucleotide sequence for HCMV AD169 UL33 spliced

ATGGACACCATCATCCACAACTCGACCCGCAACAACACTCCTCCGCACATCAATG
ACACTTGCAACATGACAGGGCCGCTATTCGCCATTCGAACCACCGAAGCCGTACT
CAACACATTCATCATCTTCGTGGGCGGTCCACTTAACGCCATAGTGTTGATCACG
CAGCTGCTCACGAATCGCGTGCTTGGCTATTCGACGCCCACCATTTACATGACCA
ACCTCTACTCTACTAATTTTCTCACGCTTACTGTGCTACCCTTTATCGTACTCAGC
AACCAGTGGCTGTTGCCGGCCGGCGTGGCCTCGTGTAAATTTCTATCGGTGATCT
ACTACTCAAGCTGCACAGTGGGCTTTGCCACCGTAGCTCTGATCGCCGCCGATCG
TTATCGCGTCCTTCATAAACGAACATACGCACGCCAATCATACCGTTCAACCTAT
ATGATTTTGCTATTGACATGGCTCGCTGGACTAATTTTTTCCGTGCCCGCAGCTGT
TTACACCACGGTGGTGATGCATCACGATGCCAACGATACCAATAATACTAATGG
GCACGCCACCTGTGTACTGTACTTCGTAGCTGAAGAAGTGCACACAGTGCTGCTT
TCGTGGAAAGTGCTGCTGACGATGGTATGGGGTGCCGCACCCGTGATAATGATG
ACGTGGTTCTACGCATTCTTCTACTCAACCGTACAGCGCACGTCACAGAAACAAA
GGAGTCGTACCTTAACCTTTGTTAGCGTGCTACTCATCTCCTTCGTGGCGCTACAA
ACTCCCTACGTCTCTCTCATGATCTTCAACAGTTATGCCACAACCGCCTGGCCCAT
GCAGTGTGAACACCTCACACTGCGACGCACCATTGGCACGCTGGCGCGTGTGGT
GCCCCACCTACACTGCCTCATTAATCCCATCCTGTACGCGCTGCTGGGTCATGATT
TTCTGCAACGCATGCGGCAGTGTTTCCGCGGTCAGTTGCTGGACCGCCGCGCTTT
CCTGAGATCGCAGCAGAATCAGCGAGCTACAGCGGAGACAAATCTAGCGGCTGG
CAACAATTCACAATCAGTGGCTACGTCATTAGACACCAATAGCAAAAACTACAA

TCAGCACGCCAAACGCAGCGTGTCTTTCAATTTTCCCAGCGGTACGTGGAAAGGC
GGCCAGAAAACCGCGTCCAACGACACATCCACAAAAATCCCCCATCGACTCTCA
CAATCGCATCATAACCTCAGCGGGGTATGA

SEQ ID NO:22

Amino acid sequence for HCMV AD169 UL33 spliced

MDTIIHNSTRNNTPPHINDTCNMTGPLFAIRTTEAVLNTFIIFVGGPLNAIVLITQLLTN
RVLGYSTPTIYMTNLYSTNFLTLTVLPFIVLSNQWLLPAGVASCKFLSVIYYSSCTVGF
ATVALIAADRYRVLHKRTYARQSYRSTYMILLLTWLAGLIFSVPAAVYTTVVMHHD
ANDTNNTNGHATCVLYFVAEEVHTVLLSWKVLLTMVWGAAPVIMMTWFYAFFYS
TVQRTSQKQRSRTLTFVSVLLISFVALQTPYVSLMIFNSYATTAWPMQCEHLTLRRTI
GTLARVVPHLHCLINPILYALLGHDFLQRMRQCFRGQLLDRRAFLRSQQNQRATAET
NLAAGNNSQSVATSLDTNSKNYNQHAKRSVSFNFPSGTWKGGQKTASNDTSTKIPH
RLSQSHHNLSGV*

SEQ ID NO:23

Nucleotide sequence for RhUL33

ATGACCAATCTTTACTCTGCCAATTTTCTCACCTTGATAGTACTTCCTTTTATCGTT
TTAAGCAATCAACACCTTTTACCTGCCAGTGCAGTAACCTGTAAATTTCTCTCCCT
GTTGTACTACTCTAGCTGCAGCGTAGGTTTTGCTACAGTGGCACTGATAGCGGCC
GACCGATACCGAGTGATTCATCGCCGAACTCAAGCTCGCCAATCCTACCGTAACA
CATATATGATAGTAGGCTTAACGTGGCTCATTGGCTTGATCTGCGCTACCCCCGG
GGGGGTCTACACAACCATTGTAGCTCACCGCGATGGGGAAAGTGATGCTCAAAG
ACACAATACTTGCATTATGCACTTTGCGTATGATGAAGTTTACGTCCTCATGGTCT
GGAAACTTCTCATCGTTTTAGTCTGGGGCATAGTGCCAGTTGTCATGATGAGCTG
GTTTTACGCGTTTTTTTACAATACTGTACAAAGAACAGCCAAAAAAACAACAACGT
ACGTTGAAATTCGTAAAGGTATTACTCCTGTCATTCATCATCATCCAAACTCCCTA
TGTGTCAATCATGATTTTTAACACGTATGCCACCGTAGGATGGCCGATGGAATGC
GCCGATCTAACTAGACGCCGAGTCATCAACACGTTTTCCCGTCTCGTCCCCAATC
TACATTGCATGGTCAACCCCATCCTCTACGCTCTCATGGGAAATGACTTTGTGTCT
AAAGTGGGCCAATGCTTTCGGGGGGAACTCACGAACCGTCGAACTTTTCTGCGTT
CCAAGCAACAAGCCCGCAACTCGGACGATGTACCGACAATTGTCAGTCAACAAC

CCGCCACACCCACCATCGTCAATAAGCCCGAAAAAAACCCGCACGTAAAACGCG
GTGTATCTTTCAGCGTCAGCGCATCTTCCGAACTCGCAGCGGCCAAAAAAGCCAA
AGACAAAGCCAAGCGGCTTTCCATGTCCCACCAAAACCTACGTCTGACGTGA

SEQ ID NO:24

Amino acid sequence for RhUL33

MTNLYSANFLTLIVLPFIVLSNQHLLPASAVTCKFLSLLYYSSCSVGFATVALIAADRY
RVIHRRTQARQSYRNTYMIVGLTWLIGLICATPGGVYTTIVAHRDGESDAQRHNTCI
MHFAYDEVYVLMVWKLLIVLVWGIVPVVMMSWFYAFFYNTVQRTAKKQQRTLKF
VKVLLLSFIIIQTPYVSIMIFNTYATVGWPMECADLTRRRVINTFSRLVPNLHCMVNPI
LYALMGNDFVSKVGQCFRGELTNRRTFLRSKQQARNSDDVPTIVSQQPATPTIVNKP
EKNPHVKRGVSFSVSASSELAAAKKAKDKAKRLSMSHQNLRLT*

SEQ ID NO:25

Nucleotide sequence for RhUL33 spliced

ATGGCAGTCACTTTACGAGGCGGCAGCCCGATAAACTTTAAACTCATGATTGTCA
GCCACAGAAACCGGAAATTTCACGAGATACGGCTGTTTCAGCGTTCTGCTATCCG
TCCAGGCGGGTTATGGAAACCATTCTTCACAACCGAACGAGTGAAACTAATTCCA
TTTTGCACATCAACACCACCTGCAATGTGACCGACTCACTGTACGCCGCCAAACT
AGGCGAAGCCCTCGTGAACAGCGCGCTAGCTTTATTCGGTACCCCCCTCAACGCC
ATCGTCCTCGTCACACAGCTATTGGCCAACCGAGTTCATGGATACTCCACCCCGA
TTATCTACATGACCAATCTTTACTCTGCCAATTTTCTCACCTTGATAGTACTTCCTT
TTATCGTTTTAAGCAATCAACACCTTTTACCTGCCAGTGCAGTAACCTGTAAATTT
CTCTCCCTGTTGTACTACTCTAGCTGCAGCGTAGGTTTTGCTACAGTGGCACTGAT
AGCGGCCGACCGATACCGAGTGATTCATCGCCGAACTCAAGCTCGCCAATCCTAC
CGTAACACATATATGATAGTAGGCTTAACGTGGCTCATTGGCTTGATCTGCGCTA
CCCCCGGGGGGGTCTACACAACCATTGTAGCTCACCGCGATGGGGAAAGTGATG
CTCAAAGACACAATACTTGCATTATGCACTTTGCGTATGATGAAGTTTACGTCCT
CATGGTCTGGAAACTTCTCATCGTTTTAGTCTGGGGCATAGTGCCAGTTGTCATG
ATGAGCTGGTTTTACGCGTTTTTTTACAATACTGTACAAAGAACAGCCAAAAAAC
AACAACGTACGTTGAAATTCGTAAAGGTATTACTCCTGTCATTCATCATCATCCA
AACTCCCTATGTGTCAATCATGATTTTTAACACGTATGCCACCGTAGGATGGCCG

ATGGAATGCGCCGATCTAACTAGACGCCGAGTCATCAACACGTTTTCCCGTCTCG
TCCCCAATCTACATTGCATGGTCAACCCCATCCTCTACGCTCTCATGGGAAATGA
CTTTGTGTCTAAAGTGGGCCAATGCTTTCGGGGGGAACTCACGAACCGTCGAACT
TTTCTGCGTTCCAAGCAACAAGCCCGCAACTCGGACGATGTACCGACAATTGTCA
GTCAACAACCCGCCACACCCACCATCGTCAATAAGCCCGAAAAAAACCCGCACG
TAAAACGCGGTGTATCTTTCAGCGTCAGCGCATCTTCCGAACTCGCAGCGGCCAA
AAAAGCCAAAGACAAAGCCAAGCGGCTTTCCATGTCCCACCAAAACCTACGTCT
GACGTGA

SEQ ID NO:26

Amino acid sequence for RhUL33 spliced

MAVTLRGGSPINFKLMIVSHRNRKFHEIRLFQRSAIRPGGLWKPFFTTERETNSILHIN
TTCNVTDSLYAAKLGEALVNSALALFGTPLNAIVLVTQLLANRVHGYSTPIIYMTNL
YSANFLTLIVLPFIVLSNQHLLPASAVTCKFLSLLYYSSCSVGFATVALIAADRYRVIH
RRTQARQSYRNTYMIVGLTWLIGLICATPGGVYTTIVAHRDGESDAQRHNTCIMHFA
YDEVYVLMVWKLLIVLVWGIVPVVMMSWFYAFFYNTVQRTAKKQQRTLKFVKVL
LLSFIIIQTPYVSIMIFNTYATVGWPMECADLTRRRVINTFSRLVPNLHCMVNPILYAL
MGNDFVSKVGQCFRGELTNRRTFLRSKQQARNSDDVPTIVSQQPATPTIVNKPEKNP
HVKRGVSFSVSASSELAAAKKAKDKAKRLSMSHQNLRLT*

SEQ ID NO:27

CGGCCAAGATGTCCCAAGAGGTTCTGACATGAACAATCACTTTTCCGAGATAGAT
GAGTTTGTTAGTGGCATTTACCAGAGAACTATTGGAGTGACGCTCAAGATGAAGC
TTCACTGGCCGTATTTCGAACATATTGTTAGATATAGCTAGTAAAGAATCTTCTA
AAGCCATGACGTCTTTCTGACGAAGTTGAATAAATTCTATCTCACCAGTACCCAA
AGGCTGACACTCAGACAACTTTGCCAAGGCCGTTGCACCCACCATGGCATTCTGA
ATCACAGTAACATCCGTCCGAGAATCGTCACCAAAAACGGTGGCCTCCAAAGTT
CGCAGGTGAGGCCGAGCCTTTACTGGATCTCGGAAGGGATACATGTGTGCTCGCC
GAGTGACAGCATTAGCATTAACCTCAAACTCATCTAAAAGCGATGATAAATCAG
GAATATGATAGCGCAATTCTCGATAGTAGGCCAACCAGAGGACTAATTGGTTGA
ACAGACAGCTCCGTCTGTGCAAAAACTTTTCGCCGCATTTTCTGAGAATTTTAGG
ATGCTGCTCTAAATCTACGTTCTCTTTAGTCGGCAGGGTCTTTAAAAAGTTAGTG
ATGGCAGTCACTTTACGAGGCGGCAGCCCGATAAACTTTAAACTCATGATTGTCA

GCCACAGAAACCGGAAATTTCACGAGATACGGCTGTTTCAGCGTTCTGCTATCCG
TCCAGGCGGGTTATGGAAACCATTCTTCACAACCGAACGGTGAGTGACATTTAAG
ACAGTTTAATAGCCAACACTCGTAACGTCTCGGAAGCTGATAAGTTTCGTTTTTC
CACAGAGTGAAACTAATTCCATTTTGCACATCAACACCACCTGCAATGTGACCGA
CTCACTGTACGCCGCCAAACTAGGCGAAGCCCTCGTGAACAGCGCGCTAGCTTTA
TTCGGTACCCCCCTCAACGCCATCGTCCTCGTCACACAGCTATTGGCCAACCGAG
TTCATGGATACTCCACCCCGATTATCTACATGACCAATCTTTACTCTGCCAATTTT
CTCACCTTGATAGTACTTCCTTTTATCGTTTTAAGCAATCAACACCTTTTACCTGC
CAGTGCAGTAACCTGTAAATTTCTCTCCCTGTTGTACTACTCTAGCTGCAGCGTAG
GTTTTGCTACAGCGGCACTGATAGCGGCCGACCGATACCGAGTGATTCATCGCCG
AACTCAAGCTCGCCAATCCTACCGTAACACATATATGATAGTAGGCTTAACGTGG
CTCATTGGCTTGATCTGCGCTACCCCCGGGGGGGGTCTACACAACCATTGTAGCTC
ACCGCGATGGGGAAAGTGATGCTCAAAGACACAATACTTGCATTATGCACTTTGC
GTATGATGAAGTTTACGTCCTCATGGTCTGGAAACTTCTCATCGTTTTAGTCTGGG
GCATAGTGCCAGTTGTCATGATGAGCTGGTTTTACGCGTTTTTTTACAATACTGTA
CAAAGAACAGCCAAAAAACAACAACGTACGTTGAAATTCGTAAAGGTATTACTC
CTGTCATTCATCATCATCCAAACTCCCTATGTGTCAATCATGATTTTTAACACGTA
TGCCACCGTAGGATGGCCGATGGAATGCGCCGATCTAACTAGACGCCGAGTCAT
CAACACGTTTTCCCGTCTCGTCCCCAATCTACATTGCATGGTCAACCCCATCCTCT
ACGCTCTCATGGGAAATGACTTTGTGTCTAAAGTGGGCCAATGCTTTCGGGGGGA
ACTCACGAACCGTCGAACTTTTCTGCGTTCCAAGCAACAAGCCCGCAACTCGGAC
GATGTACCGACAATTGTCAGTCAACAACCCGCCACACCCACCATCGTCAATAAGC
CCGAAAAAAAACCCGCACGTAAAACGCGGTGTATCTTTCAGCGTCAGCGCATCTTC
CGAACTCGCAGCGGCCAAAAAAGCCAAAGACAAAGCCAAGCGGCTTTCCATGTC
CCACCAAAACCTACGTCTGACGTGAATTTTCCTAGAGGCTGCCTCCACGGGTTTA
CATACATATCTCGGTACTTGCTACACTTGATCACTTTACTGCGGACACCACGGCC
AATCGCATC